Accelerating the Implementation of the Sendai Framework for Disaster Risk Reduction: The Role of the International Scientific Programme on *Integrated Research on Disaster Risk*

1 Introduction

Progress reported by Member States under the Sendai Framework for Disaster Risk Reduction 2015–2030 (SFDRR) indicates uneven advancement across its global targets[1]. While signatory countries have made measurable progress in implementation of the framework, achievements vary significantly. Improvements are most evident for global targets A, E, and G, whereas progress toward global targets B, C, D, and F remains limited or absent. Accelerating the SFDRR implementation requires sustained and coordinated action across governance, policy, financing, and science and technology (S&T), supported by meaningful community engagement[1].

The Community of the International Programme on Integrated Research on Disaster Risk (IRDR), comprising the Scientific Committee, National Committees, International Centres of Excellence (ICoEs), the International Programme Office, the International Young Scientists Programme, and IRDR Fellows, plays a critical role in strengthening the use of research, innovation, data, and technological systems to reduce disaster risk, enhance preparedness, and support resilient and sustainable development. The IRDR community is well positioned to assess what has and has not been effective under the SFDRR and to identify areas of improvements that could accelerate progress during the remaining implementation period and inform the design of a post-2030 disaster risk reduction (DRR) framework. Such contributions are particularly relevant considering anticipated government-led negotiations on a future framework, expected to commence in 2027. Any future DRR framework will require broad political consensus for adoption[2].

To inform these processes, IRDR should critically assess its role in advancing integrated research on disaster risk in relation to both SFDRR implementation and emerging priorities for the post-2030 period. This document highlights how the IRDR community can contribute to accelerating the SFDRR implementation and identifies priority research and policy-relevant actions through which IRDR can add value to global disaster risk reduction efforts.

2 Accelerating the SFDRR Implementation

Enhancement in implementation of the SFDRR should be understood as the rapid translation of knowledge, policy guidance, and investments into measurable progress across the four SFDRR priorities.

Priority 1: Understanding disaster risk. Risk understanding has been improving over the past decades based on monitoring and collection of data on disaster risk (including hazards, vulnerabilities, exposure, capacities), integrated analysis, modelling and interpretations. An enhancement of this understanding requires significant input from the Science & Technology (S&T) community to generate actionable knowledge on existing and emerging risks, including cascading and compound hazards and risks; to assess risk likelihood and potential impacts; and to identify physical, social, economic, institutional, and environmental vulnerabilities. Equally important is the translation of risk information into policy-relevant formats that support evidence-based decision-making at national, regional, and local levels. The IRDR community, in collaboration with the International Science Council (ISC) and the United Nations Office for Disaster Risk Reduction

(UNDRR), should actively work on better understanding disaster risk and contribute to strengthening the science–policy interface by supporting integrated research on disaster risk, risk assessments and improving risk communication for policymakers and communities[3].

Priority 2: Strengthening disaster risk governance to manage disaster risk. Accelerated implementation of the SFDRR requires strong and coherent disaster risk governance frameworks[1]. This includes clear institutional mandates, coordination mechanisms across sectors and levels of government, and the integration of DRR into development planning. Scientific input is critical in identifying governance gaps, documenting best practices, and informing policy reform. IRDR supports this process through policy briefs and evidence-based recommendations on DRR governance[4,5]. Wider uptake and implementation of these recommendations would significantly accelerate SFDRR progress, yet this remains a key implementation challenge.

Priority 3: Investing in disaster risk reduction for resilience. Achieving resilience at scale requires a decisive shift from reactive disaster spending toward proactive investment in risk reduction. This priority calls for aligning public and private finance with DRR objectives and integrating risk considerations into infrastructure, land-use planning, and development investments. While IRDR contributes through integrated research on disaster risks, capacity development, and resilience frameworks, accelerated progress requires political commitment and the wider mobilization of financial resources from national budgets, international financial institutions, and development partners[1,6].

Priority 4: Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction**.** While global awareness of disaster risk has increased, DRR mechanisms remain focused on responding to crises rather than on proactively preventing and reducing risk[1]. Policy action under this priority should focus on strengthening preparedness systems including anticipatory actions, early warning, contingency planning, and institutional readiness, as well as ensuring that recovery and reconstruction processes reduce future risk. IRDR supports evidence-based preparedness and recovery policies through scientific contributions that inform planning, operational readiness, and the application of the "Build Back Better" principles in disaster recovery. Disasters are not inevitable consequences of hazards when key disaster drivers[7], including physical and social vulnerabilities, are reduced through the deliberate selection and implementation of preventive measures prior to the occurrence of disasters[8-10]. "Where prevention is prioritised, losses fall, and resilience grows"[11].

Guided by its mission and vision, IRDR supports effective cooperation among research community, policymakers, disaster risk management authorities, and the societies by improving understanding of risk and uncertainty that constrain sustainable development, promoting innovation in DRR research and practice, and strengthening institutional capacities across diverse socio-economic and cultural contexts[12]. Through these policy-relevant contributions, IRDR plays a significant role in providing evidence for knowledge-informed policymaking to enhance the SFDRR implementation and to advance risk-informed development.

3 IRDR Specific Priorities

3.1 Harness Technologies, Innovations, Data, and Knowledge for Risk Reduction

Understanding the dynamic nature of hazards, exposure, vulnerability, capacities, and resilience is fundamental to effective DRR[13]. Accordingly, the priority area *"Harnessing technologies, innovation, data, and knowledge for risk reduction"* is identified as a key focus for IRDR in the coming years[14]. IRDR aims to support and promote the transformation of data and technology into actionable intelligence for DRR and the acceleration of resilience.

Key IRDR actions in this priority area include:

Research

- promoting integrated research and modelling on disaster risks, including cascading and compound risks, climate/infrastructure/health interactions; early warning; emerging risks, and extreme hazards;
- advancing the use of geospatial data and emerging technologies, such as artificial intelligence (AI) and machine learning (ML), for predictive modelling and real-time risk analytics, as well as the use of remote sensing and geographic information systems (GIS) for hazard monitoring, loss assessment, and dynamic risk mapping;
- promoting research on development of comprehensive evaluation of the SFDRR framework as well as future post-2030 frameworks to guide implementation and increase accountability;

Data

- promoting the development of integrated data platforms for hazard, vulnerability, exposure, and capacity mapping;
- strengthening disaster loss databases to support evidence-based planning, monitoring, and reporting;
- establishing open-access repositories for disaster risk data and scientific outputs; promoting open data sharing among governments, academia, and civil society; and
- promoting the development, adoption, and use of integrated information systems in national, regional and local contexts, with a special focus on datasets and models that could inform decision-making and foster collaboration across public and private sectors.

Technology and Innovation

- supporting the use of the Internet of Things and sensor technologies for community-level early warning systems and rapid impact assessment;
- encouraging the adoption of digital tools for emergency response coordination and community alert systems, reducing the digital divide; and
- fostering innovation hubs, living labs, and pilot initiatives focused on DRR and climate resilience.

3.2 Address Inequalities, Injustices, Marginalization and Vulnerabilities

This area constitutes another priority action for IRDR. The IRDR programme for 2025-2027 intends to promote scientific research and knowledge generation in risk science that strengthens disaster risk governance, policy, and practice, with a focus on justice, equity, and inclusion. In particular, IRDR supports approaches that ensure the needs and perspectives of the most disadvantaged and marginalized populations and communities are reflected in DRR strategies[13].

In this context, IRDR promotes research to:

- identify marginalized populations and communities most at risk;
- improve understanding of how diverse concepts of resilience and vulnerability inform policy and practice;
- address inequities, injustices, and increasing vulnerabilities from local to global scales;

- strengthen modelling approaches to resilience, including the analysis of power asymmetries and the role of misinformation, denial and strategic ignorance in risk governance[15];
- develop inclusive and participatory approaches to DRR monitoring, planning, and implementation; and
- address structural and systemic global inequalities that drive marginalization and exacerbate vulnerabilities across communities[16].

3.3 Support Regional and National Science and Knowledge for Policy and Action

IRDR promotes integrated, regionally grounded research on disaster risk through its ICoEs and broader IRDR community. These efforts are designed to address region-specific policy challenges and strengthen the application of science and knowledge to DRR at national and subnational levels.

IRDR promotes on the following regional priorities[13]:

- Africa: transboundary risks, conflict dynamics, large population movements, limited resources, and the need to strengthen local science and technology capacities;
- North America: institutional challenges arising from the complexity of vertical and horizontal governance responsibilities;
- South America and the Caribbean**:** vulnerabilities and capacity development for resilience and inclusion, with particular attention to Indigenous Peoples, diverse local voices, and transboundary issues;
- Asia and Oceania: challenges related to policy coherence and governance, highly uneven resourcing and institutional capacities across the region, and significant transboundary risks;
- Europe: all hazard of significance, including climate-related and industrial hazards; integrated risk management approaches addressing multi-risk events and their implications for justice and equity.

3.4 Strengthen Governance and Policy Integration

Effective DRR depends on coherent policies, strong institutions, and coordinated action across sectors and levels of governance. The scientific community plays a critical role in mainstreaming DRR into national and local development plans, climate change adaptation strategies, and sectoral policies (including health, agriculture, and infrastructure), as well as in supporting national and local authorities with the knowledge required for place- and context-specific DRR actions[5].

Key policy-relevant actions in this area include:

- embedding DRR priorities within national science, technology, and innovation systems, including research funding frameworks and calls;
- establishing and strengthening multi-stakeholder science–policy platforms for DRR at local and national levels, linking scientists, policymakers, and practitioners;
- institutionalizing scientific advisory mechanisms (e.g. chief science advisers for DRR and local science advisory mechanisms[5]) to inform government decision-making;
- promoting inter- and transdisciplinary collaboration across physical and social sciences, engineering, and data science; and

- encouraging universities and research councils to align curricula, training programmes, and research agendas with SFDRR priorities.

3.5 Increase Financing and Investment in DRR Science and Innovation

Chronic underfunding of DRR continues to impede effective implementation of the SFDRR, as highlighted by the recent high-level Policy Forum on Accelerated Financing for Disaster Risk Reduction to Build Resilience[6]. The scientific community, including experts in financial mathematics, economics, and related disciplines, can contribute critical knowledge to accelerate financing and investment in preventive and risk-informed measures, thereby reducing disaster losses.

To this end, the following actions are recommended:

- strengthening and establishing dedicated DRR innovation funds to support research, development, and technology start-ups, including initiatives focused on multi-hazard early warning systems (MHEWS) and on emerging risks accounting for demographic changes;
- encouraging public–private partnerships to translate scientific research into scalable and operational DRR solutions[17];
- aligning DRR financing with climate innovation and adaptation finance mechanisms, including instruments, such as the Green Climate Fund[18] and disaster resilience bonds[19];
- incentivizing open innovation challenges to advance risk data analytics, forecasting models, and decision-support tools[20]; and
- integrating disaster risk and impact assessment requirements into publicly funded research grants and broader public research and development investments.

3.6 Strengthen Local and Community Resilience

Local actors are the first responders to disasters and are central to achieving sustainable DRR. IRDR promotes the generation and application of DRR science that is accessible, useful, usable, and used for local decision-making and community-level implementation. Drawing on its collective experience and expertise, the IRDR community works to:

- encourage the co-design and co-production of knowledge between scientists and local and Indigenous communities;
- support the development of scientific centres of excellence in IRDR priority areas, linked to national and regional networks;
- strengthen the technical capacities of local governments and advocate for greater financial autonomy to support risk-informed decision-making;
- integrate local and Indigenous knowledge into risk assessment and DRR planning, including through citizen science initiatives such as community-based data collection and hazard monitoring;
- promote education and public awareness initiatives on disaster preparedness, and develop training and mentorship programmes for early-career scientists in disaster risk science and technology; and
- translate complex risk data and scientific outputs into practical guidance and decision-support tools for local governments, schools, and civil society organizations.

3.7 Enhance International Scientific Cooperation and Disaster Science Diplomacy

DRR requires sustained national, regional, and international cooperation among all stakeholders responsible for advancing risk understanding (research), managing risks (policy development and implementation), financing risk reduction (government, industry, and non-profit sectors), communicating risk (media, public, and government), and engaging with affected communities. Because the drivers and impacts of disasters frequently cross geopolitical borders, continuous collaboration and knowledge exchange among international partners are essential.

UNDRR's efforts to oversee the SFDRR, support countries in its implementation, monitor progress, and disseminate lessons on effective risk reduction exemplify disaster-related science diplomacy. This occurs both formally (through governments) and informally (through NGOs, civil society, and scientific organizations). UNDRR has implemented disaster diplomacy by convening governments, intergovernmental organizations (e.g., UNESCO, the World Meteorological Organization, the World Health Organization), and non-governmental scientific bodies (e.g., ISC and its Members). In doing so, UNDRR has fostered synergies among partners and communities around shared objectives, reinforcing the principle that international cooperation "has proven to be key to reducing disaster risk," as emphasized in the SFDRR.

ICoEs are primarily established to address/undertake local disaster risk research activities. This concept can be expanded to support disaster diplomacy efforts through the development of *national knowledge exchange centres*. Such centres can assist countries in achieving SFDRR global targets by sharing expertise, providing mutual support, and offering standardized templates to facilitate reporting. When globally interconnected, these centres can advance resilience by enabling the ethical and efficient exchange of information, strategies, and best practices for risk monitoring, assessment, and reduction[21].

To contribute to acceleration of the implementation of global target F (international cooperation for DRR), IRDR could promote establishing *national knowledge exchange centres*[21] through the following actions:

- sharing scientific knowledge, technology, and expertise through regional partnerships (e.g., ASEAN, AU, OAS, and EU) and regional DRR organizations (e.g., RMGIR[22], DRMKC[23]) ;
- developing transboundary risk management frameworks for different types of hazards[24];
- supporting capacity-building in developing countries through technical assistance and knowledge transfer;
- strengthening global science partnerships, including IRDR, UNDRR's Science & Technology Advisory Group, and the Group on Earth Observations DRR Unit;
- promoting South–South and North–South collaboration on DRR research, innovation, and technology transfer;
- establishing regional science networks to address transboundary hazards and risks;
- standardizing risk data protocols to enable cross-country comparability and multi-hazard early warning systems; and
- disseminating best practices and innovations through open-access journals, conferences, and other knowledge-sharing platforms.

3.8 Improving Monitoring, Evaluation, and Communication of DRR Science

IRDR, together with its key Partners, should ensure the accountability, relevance, and impact of its scientific contributions to DRR. To achieve this, the IRDR International Programme Office (IPO) should consider the following actions:

- tracking the scientific contributions of the IRDR community to the SFDRR global targets using measurable indicators, such as publications, datasets, innovations, and demonstrated policy impacts;
- integrating DRR scientific outcomes into national science monitoring systems and SDG reporting frameworks;
- developing metrics to assess "science uptake", i.e., the extent to which research informs policy, planning, and practice;
- promoting science communication training to support researchers in conveying risk information clearly and effectively to policymakers, practitioners, and the public; and
- publishing open progress reports on the application of science in national and local DRR implementation, enhancing transparency and knowledge sharing.

3.9 Link DRR Science with Climate, Environment, and Sustainable Development Goals

"Nothing erodes sustainable development like disasters, which can often destroy decades of progress in minutes. The failure to identify, prevent, and reduce risks before they manifest as disasters not only places the Sustainable Development Goals (SDGs) in jeopardy, it affects the most vulnerable people first and worst," stated H.E. Amina J. Mohammed, UN Deputy Secretary-General. Accelerating the SFDRR implementation is essential to getting the SDGs back on track. IRDR plays a critical role in ensuring coherence across global resilience agendas.

Key actions promoted by IRDR include:

- developing integrated risk assessment frameworks that combine climate projections, biodiversity loss, and socio-economic vulnerability;
- supporting research on nature-based and ecosystem-based solutions for DRR;
- encouraging interdisciplinary projects that align DRR science with SFDRR targets and SDGs, including efforts to explicitly link SDG indicators with DRR objectives; and
- facilitating dialogue and collaboration between DRR, climate, and development scientific communities to foster coordinated action and knowledge exchange.

4. Concluding Remarks

This section highlights targeted priorities and specific urgent actions through which the IRDR community can support the accelerated implementation of the SFDRR, reinforcing global resilience and risk-informed development agendas.

Targeted Priorities

1. *Operationalize Science* – Translate knowledge into informed decision-making.
2. *Data and Systems Integration* – Ensure hazard, exposure, vulnerability, capacity, and impact data are interoperable, standardized, and openly accessible.

3. *Local Capacity and Co-Production* – Strengthen scientific capabilities at the subnational level and co-produce knowledge with communities[5].
4. *Finance and Incentives* – Support public–private pilots that demonstrate measurable risk reduction as well as case studies of diverse financial strategies that demonstrate their potential success in DRR.
5. *Science–Policy Uptake* – Build institutional and operational bridges so that decision-makers effectively use scientific outputs in planning and procurement.

Specific Urgent Actions

IRDR can and should promote and support:

1. operationalizing models into decision tools (i.e., converting research models into practical decision-support DRR products) for local planners and responders (*to contribute to enhancing the implementation of global target B*);

2. developing multi-hazard early warning systems by integrating physical sensors, remote sensing, modelling, and appropriate local alert channels (e.g., SMS, radio, community messengers) to ensure warnings are actionable, context-specific, and locally relevant, and "no one left behind" (*to contribute to enhancing the implementation of global target C*);

3. establishing regional living labs and knowledge exchange centres to facilitate co-designed and co-produced research, tools, and products by researchers, local communities, and other DRR stakeholders, and to address transboundary hazards/risks more effectively (*to contribute to enhancing the implementation of global target F*);

4. creating science-to-policy mechanisms by appointments of DRR science advisers and/or local advisory board on DRR (*to contribute to enhancing the implementation of global targets B and D*); and

5. developing comprehensive evaluation tools for measuring the SFDRR implementations.

References

[1] UNGA (2025). Implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030. Report of the Secretary-General. United Nations General Assembly. Available at: https://www.undrr.org/publication/un-resolutions-and-reports/report-secretary-general-implementation-sendai-framework (accessed on January 15, 2026).

[2] Allen, C., Malekpour, S., Weitz, N., Bennich, T., Pedercini, M., Sagar, A., Griggs, D., Raven, R., Sun, Y., Pradhan, P., Carole-Anne Sénit, C.-A., Stevance, A.-S.,Leininger, J., Lafortune, G., Ordoñez Llanos, A., Onoda, S., Fernando, G., Lechner, A.M., Mohan, A.V., Guan, T., Kestin, T., Capon, A., and Nilsson, M. (2026). A theory of change approach to enhance the post-2030 sustainable development agenda, *Science* **391**, 241-244, https://doi.org/10.1126/science.adz5704

[3] https://www.irdrinternational.org/knowledge_pool/publications/

[4] Ismail-Zadeh, A. and Cutter, S., eds. (2015). Disaster Risks Research and Assessment to Promote Risk Reduction and Management. ICSU-ISSC, Paris. Available at: https://council.science/news/new-paper-disaster-risks-research-and-assessment-to-promote-risk-reduction-and-management/ (accessed on January 15, 2026).

[5] IRDR (2025). Disaster Risk Reduction Products and Processes: Knowledge Sharing for Place- and Context-Specific Actions. Policy Brief [Writing Team: Ruiz-Rivera, N., Garcia Ferrari, M. S.,

Ismail-Zadeh, A., Yang, S., Garimoi Orach C., Azahari Razak, K, Ngaira, J., and Lian, F.] Integrated Research on Disaster Risk, International Programme Office, Beijing, China. Available at: https://www.irdrinternational.org/knowledge_pool/publications/131 (accessed on January 15, 2026).

[6] UNDRR (2025). High-Level Policy Forum on Accelerated Financing for Disaster Risk Reduction (DRR) to Build Resilience. Oslo, Norway, March 25-26, 2025. Co-Chairs Summary. Available at: https://www.undrr.org/media/105875 (accessed on January 15, 2026).

[7] Ismail-Zadeh, A. (2022). Natural hazards and climate change are not drivers of disasters, *Natural Hazards* **111**, 2147-2154, https://doi.org/10.1007/s11069-021-05100-1

[8] Ismail-Zadeh, A. and Takeuchi, K. (2007). Preventive disaster management of extreme natural events, *Natural Hazards* **42**, 459-467, https://doi.org/10.1007/s11069-006-9075-0.

[9] Cutter, S, Ismail-Zadeh, A., Alcántara-Ayala, I., Altan, O., Baker D. N., Briceño, S., Gupta, H., Holloway, A., Johnston, D., McBean, G. A., Ogawa, Y., Paton, D., Porio, E., Silbereisen, R. K., Takeuchi, K., Valsecchi, G. B., Vogel, C., and Wu, G. (2015). Pool knowledge to stem losses from disasters, *Nature* **522**, 277-279, https://www.nature.com/articles/522277a

[10] UNDRR and WMO (2022) Global status of multi-hazard early warning systems: Target G, United Nations Office for Disaster Risk Reduction. Available at: https://www.irdrinternational.org/knowledge_pool/publications/104 (accessed on January 15, 2026).

[11] A year of evidence showing the impact of disaster risk reduction (https://www.preventionweb.net/quick/99652)

[12] IRDR New Mission (https://www.irdrinternational.org/what_we_do/overview/)

[13] ISC-UNDRR-IRDR (2021). A Framework for Global Science in support of Risk Informed Sustainable Development and Planetary Health [eds Handmer, J.; Vogel, C.; Payne, B; Stevance, A.-S.; Kirsch-Wood, J.; Boyland, M.; Han, Q.; and Lian, F.]; International Science Council, Paris, France; United Nations Office for Disaster Risk Reduction, Geneva, Switzerland; Integrated Research on Disaster Risk, IPO, Beijing, China. DOI: 10.24948/2021.07.

[14] IRDR Action Plan (https://www.irdrinternational.org/upload/20241211/a117c235ce8ad8.pdf)

[15] Vicari, R., Komendatova, N., Elroy, O., Dallo, I., Rapaport, C., De Carolis, C., & Yosipof, A. (2025). A toolbox to deal with misinformation in disaster risk management. AI & Society. https://doi.org/10.1007/s00146-025-02680-5

[16] UNESCO (2018). World Inequality Report, UNESCO, Paris. Available at: https://wir2018.wid.world (accessed on January 15, 2026).

[17] Wirtz, A., Löw, P., Mahl, T., and Yildirim, S. (2014). Hitting the poor: public–private partnership as an option: Impact of natural catastrophes on economies at various stages of development. In: Ismail-Zadeh A, Urrutia Fucugauchi J, Kijko A, Takeuchi K, Zaliapin I, eds. *Extreme Natural Hazards, Disaster Risks and Societal Implications*. Cambridge: Cambridge University Press, pp. 386-398, https://doi.org/10.1017/CBO9781139523905.038

[18] Green Climate Fund (https://www.greenclimate.fund/)

[19] The Coalition for Private Investment in Conservation https://www.cpicfinance.com/blueprints/resilience-bond-for-risk-reduction/

[20] Broekhuizen, T., Dekker, H., de Faria, P., Firk, S., Khoi Nguyen D., and Sofka, W. (2023). AI for managing open innovation: Opportunities, challenges, and a research agenda, *Journal of Business Research* **167**, 114196, https://doi.org/10.1016/j.jbusres.2023.114196.

[21] Kontar, Y. Y., Ismail-Zadeh, A., Berkman, P. A., Duda, P. I., Gluckman, P., Kelman, I., and Murray, V. (2021). Knowledge exchange through science diplomacy to assist disaster risk reduction, *Progress in Disaster Science* **11**, 100188. https://www.sciencedirect.com/science/article/pii/S259006172100048X.

[22] Mesoamerican Network of Geospatial Information (https://www.proyectomesoamerica.org/index.php/ejes-de-trabajo/eje-social/gestion-de-riesgo)

[23] Disaster Risk Management Knowledge Centre (https://drmkc.jrc.ec.europa.eu/)

[24] HIP (2025). Hazard Information Profiles (HIPs) online reference. Available at: https://www.preventionweb.net/drr-glossary/hips (accessed on January 15, 2026).

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